DECREASED BLOOD-PRESSURE IN PHARMACOLOGICALLY TREATED HYPERTENSIVE PATIENTS WHO REGULARLY ELICITED THE RELAXATION RESPONSE

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Summary A wakeful hypometabolic state may be induced by simple, non-cultic mental techniques or by traditional meditational practices. The hypometabolic state seems to represent an integrated hypothalamic response ("relaxation response") which is consistent with a state of decreased sympathetic-nervous-system activity. A prospective investigation was designed to test whether regular elicitation of the relaxation response might lower blood-pressures in hypertensive patients who were maintained on constant antihypertensive therapy. Fourteen people were investigated. During the control period of 5.6 weeks, blood-pressures did not change significantly from day to day and averaged 145.6 mm.Hg systolic and 91.9 mm.Hg diastolic. During the experimental period of 20 weeks, systolic blood-pressures decreased to 135.0 mm.Hg ($P < 0.01$) and diastolic blood-pressures fell to 87.0 mm.Hg ($P < 0.05$). The regular elicitation of the relaxation response may, therefore, have usefulness in the management of hypertensive subjects who are already on drug therapy. The use of the relaxation response may influence the economics of the therapy of hypertension since it is practised at no cost other than time.

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Introduction

A WAKEFUL hypometabolic state may be induced by the use of simple, non-cultic mental techniques or by traditional meditational practices.[1-4] The hypometabolic state is characterised by decreased oxygen consumption, carbon-dioxide elimination, respiratory-rate, and minute ventilation with no change in respiratory quotient. There is a marked decrease in arterial-blood lactate and a slight decrease in arterial-blood pH and base excess. In subjects experienced in the elicitation of the hypometabolic state, intra-arterial blood-pressures are low before, during, and after its practice. The hypometabolic state seems to represent an integrated hypothalamic response, termed the "relaxation response," which is consistent with a state of decreased sympathetic-nervous-system activity.[5] The relaxation response is suggested to be the counterpart of another hypothalamic response—the emergency reaction of Cannon,[6,7] which is popularly called the fight or flight response.

Continual elicitation of the emergency reaction with its resultant increased sympathetic-nervous-system activity has been implicated in the pathogenesis of systemic arterial hypertension.[8,9] The relaxation response may serve to counteract the effects of the fight or flight response, therefore we investigated the therapeutic usefulness of the relaxation response in hypertensive individuals. In a prospective study of twenty-two patients with untreated borderline hypertension, blood-pressures averaged 146.5 mm.Hg systolic and 94.6 mm.Hg diastolic during the control period, which averaged 6 weeks.[10] During the subsequent 25-week experimental period when the patients regularly elicited the relaxation response, blood-pressures fell to 139.5 mm.Hg systolic ($P < 0.001$) and to 90.8 mm.Hg diastolic ($P < 0.002$). Measurements were made at random times of the day, but never during meditation.

We have extended the investigation to patients taking antihypertensive medications. Significant decreases in both systolic and diastolic blood-pressures were noted after beginning the regular elicitation of this hypometabolic response.

Methods

The technique used to elicit the relaxation response was transcendental meditation. Transcendental meditation is individually taught by a teacher trained in this Indian yogic technique by Maharishi Mahesh Yogi. The instruction is given by a non-profit organisation, the International Meditation Society, and costs $75 for the four consecutive daily lessons required. The technique involves:

A mental device.—There is a constant stimulus of a silently repeated secret sound or word called a mantra. The

purpose of this repetition is to free one's self from logical, externally oriented thought. The eyes remain closed throughout the practice.

A passive attitude.—If distracting thoughts do occur during repetition, they should be disregarded and one's attention should be redirected to the mantra. One should not worry about how well one is performing the technique.

Decreased muscle tonus.—The subject should sit in a comfortable position so that minimal muscular work is required.

Regular practice.—The subject is instructed to practise the technique for two daily 20-minute periods, usually before breakfast and before dinner.

No contact with the International Meditation Society is required after initiation, although it is encouraged. Emphasis is placed upon having a trained teacher both to initiate the subject and to "check" the meditation periodically.

The fourteen subjects volunteered to take part in this investigation while at introductory lectures on transcendental meditation given by the Students International Meditation Society in Cambridge, Massachusetts, in Berkeley and Los Angeles, California, and in Minneapolis, Minnesota. At these lectures, an offer was made to waive the regular instruction fee for those individuals who knew they had hypertension, and who would postpone learning the technique for approximately 6 weeks during which control blood-pressure measurements were made. The fee was either waived by the Society or paid from research-grant funds. The subjects also agreed to return every 2–3 weeks for at least a year after learning the technique to have their blood-pressures measured. Before the subject was accepted in the investigation, blood-pressures were measured three or four times over a period of 15–20 minutes and had to be either greater than 140 mm.Hg systolic or 90 mm.Hg diastolic, or both, on the last measurement. These arbitrary levels are higher than those considered to be normotensive.[11]

On each day of measurement, before the blood-pressures were recorded, each subject filled out a questionnaire. The questionnaire assessed the amount and type of medication, including antihypertensive medication, which was being used. It also established the frequency of meditation and the dietary habits of the subjects. Each subject was instructed to adhere to the medication schedule prescribed by his physician. In this investigation, all of the fourteen subjects remained on constant antihypertensive medications during both the premeditation (control) and postmeditation (experimental) periods. One was taking diazepam; seven were taking chlordiazepoxide or diazepam and one of either a benzothiadiazine derivative, one of the rauwolfia alkaloids, or spironolactone; three were taking chlordiazepoxide or diazepam and two or three of the following drugs: a benzothiadiazine derivative, one of the rauwolfia alkaloids, and spironolactone; and three were taking methyldopa and a benzothiadiazine derivative. Sixty-four people volunteered for the study, but fifty had either altered their antihypertensive medication or diet and therefore were excluded from the study due to the uncontrolled effects of these changes.

Blood-pressure was measured by means of a random-zero sphygmomanometer.[12] This device consists of a standard blood-pressure cuff and air-inflation system with a visible calibrated mercury column. The random-zero sphygmomanometer varies the zero position of the mercury column in a random manner, adding 0–60 mm.Hg to the column before each reading. Only at the end of each measurement is the actual "zero" for the column of mercury known to the person measuring the blood-pressure. Thus, observer bias is eliminated. The disappearance of the Korotkoff sounds (phase v) was used as the criterion for determining diastolic blood pressure. Recordings were taken with the subject in the sitting position

During the first 5.6 weeks of the premeditation-control period, 279 measurements of blood-pressure were obtained. These control measurements were made on an average of 7 separate days. On each day, measurements were repeated every 5 minutes until both systolic and diastolic pressures did not change more than 5 mm.Hg from the preceding measurements. After each subject was trained in the practice of transcendental meditation, he or she returned on an average of 10 separate days over a period averaging 20 weeks for similar blood-pressure measurements. During the postmeditation-experimental period, 340 measurements were obtained. They were made during non-meditational periods of the day and bore no consistent relation to the meditational period. Attempts were made to have all of a given subject's measurements at the same time of day. The average systolic and diastolic blood-pressures were calculated for each patient at each visit. The premeditation-control period was divided into three intervals: 7 days or less after the initial blood-pressure reading, 8–14 days afterwards, and more than 14 days after the initial reading. The average blood-pressures for each patient within each of these three time intervals were computed. A two-way analysis of variance[13] was performed, yielding comparisons of blood-pressure levels between the three time intervals using each subject as his own control. For the postmeditation-experimental period, paired t tests were done, comparing the average blood-pressure levels within two time intervals. These two intervals were 30 days or less and more than 30 days after the first day blood-pressures were measured after the start of the regular practice of meditation. There were no significant changes of blood-pressure levels between the three premeditation-control period time intervals and between the two postmeditation-experimental period intervals. Therefore, the average blood pressure levels for the entire premeditation-control and postmeditation-experimental periods were computed and compared by paired t tests.

Results

The mean age of the participants was 53.3 years (S.D. 9.9). There were eight females and six males.

During the premeditation-control period, the systolic blood-pressures averaged 145.6 mm.Hg and the diastolic pressures 91.9 mm.Hg (table). During the postmeditation-experimental period, the systolic pressures averaged 135.0 mm.Hg and the diastolic pressures averaged 87.0 mm.Hg. Comparisons of the blood-pressures of the premeditation-control period to those of the postmeditation-experimental period yielded significant differences for both systolic ($P < 0.01$) and diastolic ($P < 0.05$) pressures.

COMPARISON OF BLOOD PRESSURE LEVELS (mm. Hg) DURING THE PREMEDITATION-CONTROL PERIOD TO THOSE OF THE POSTMEDITATION-EXPERIMENTAL PERIOD

Blood-pressure	Premeditation control period	Postmeditation experimental period	Difference
Systolic			
Mean	145.6	135.0	−10.6
S.D.	7.38	11.19	12.45
S.E.M.	1.97	2.99	3.33
Diastolic			
Mean	91.9	87.0	−4.85
S.D.	8.32	11.34	7.69
S.E.M.	2.22	3.03	2.05

Discussion

The results show that the regular practice of a technique which elicits the relaxation response is associated with decreased blood-pressures in pharmacologically treated hypertensive patients. The investigation is unbiased with regard to the alteration of antihypertensive agents, significantly altered diet, observer error, and subject familiarity with blood-pressure measurement. In this study and in the previously cited study of untreated hypertensive subjects,[10] blood-pressures were decreased by a behavioral intervention, and these data support the theory that behavioral factors play an important role in both the development and therapy of hypertension.[9]

We believe that results similar to those reported here would be obtained with other techniques which elicit the relaxation response. The basic components of the elicitation of the relaxation response (a mental device, a passive attitude, decreased muscle tonus, and regular practice) are present in a technique now employed in this laboratory.[1] The instructions for this technique are:

(1) Sit quietly in a comfortable position.
(2) Close your eyes.
(3) Deeply relax all your muscles, beginning at your feet and progressing up to your face. Keep them deeply relaxed.
(4) Breathe through your nose. Become aware of your breathing. As you breathe out, say the word "one" silently to yourself—e.g., breathe in . . . out, "one;" in . . . out, "one", and so on.
(5) Continue for 20 minutes. Occasionally open your eyes to check the time. When you finish, sit quietly for several minutes at first with closed eyes and later with opened eyes.
(6) Do not worry about whether you are successfully achieving a deep level of relaxation. Maintain a passive attitude and permit relaxation to occur at its own pace. When distracting thoughts occur, ignore them and continue repeating "one." With practice, the response should come with little effort. Practice the technique once or twice daily, and not within 2 hours after any meal, since the digestive processes seem to interfere with the elicitation of anticipated changes.

Investigations employing this technique have demonstrated the same hypometabolic changes elicited by transcendental mediation.[1] This non-cultic technique is easily learned and costs nothing.

Other investigators have also reported decreased blood-pressures in hypertensive subjects who practised a yogic technique called shavasan[14] and a yogic technique combined with biofeedback.[15] We suggest that a passive attitude is essential to the elicitation of the relaxation response, and therefore, the concentration and the attention to external stimuli required in biofeedback training[16] may actually interfere with the elicitation of the response. In addition, biofeedback requires costly physiological monitoring equipment, and this would seriously hinder its widespread application.

When the relaxation response has been elicited for two limited daily periods of 20–30 minutes, no adverse side-effects have been reported or observed. However, the side-effects of the extensive practice of the relaxation response have not been well documented.[17] When transcendental meditation has been practised for several hours daily over a period of several days, some individuals have experienced feelings of withdrawal from life and symptoms which range in severity from insomnia and uncontrolled movements of the limbs to hallucinatory experiences. These side-effects are difficult to evaluate on a retrospective basis because individuals with emotional problems might be drawn to any technique such as transcendental meditation which evangelistically promises relief from tension and stress.

No data are available in the present investigation regarding the aetiology of the subjects' hypertension. It is likely that most of the participants had essential hypertension.[18] The long-term effects and the relative preventive and therapeutic value of the relaxation response in hypertension and hypertensive disease remain to be established. If the response does have value, it will have a profound effect on the economics of the therapy of hypertension and its sequelae since it is practised at no cost other than time.

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